1. Describe or define the following terms: (3 points each, total 12points)
   a. S/N ratio
   b. calibration
   c. error propagation
   d. detection limit

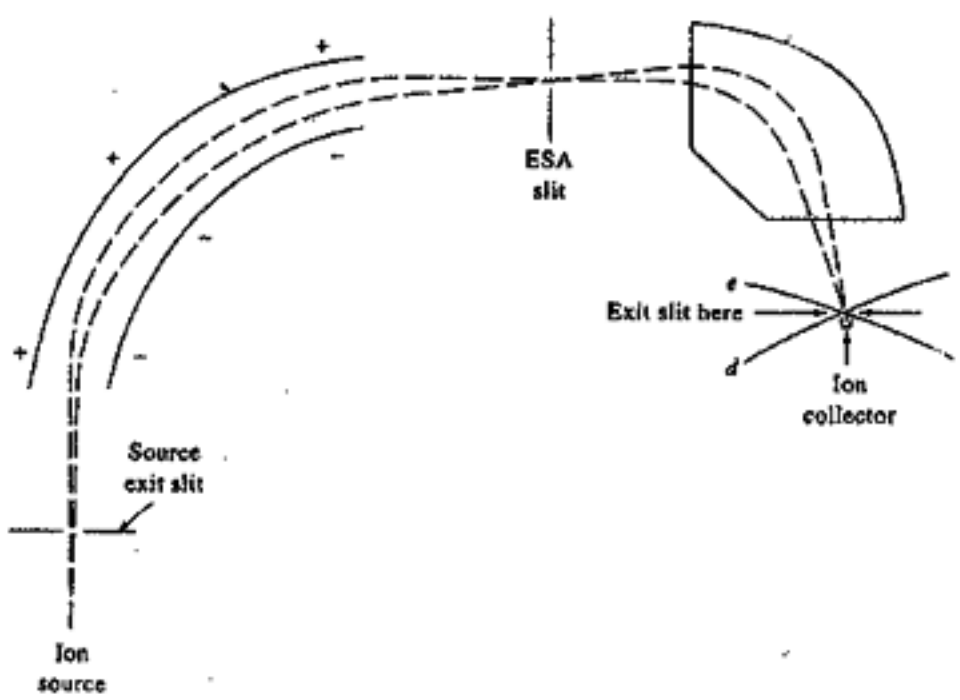
2. Calculate the equilibrium concentration of Ni^{2+} in a solution with an analytical NiY^{2-} concentration of 0.0150 M at pH of 3.0. (Y= EDTA) (10 points)
   $K_{NiY} = 4.2 \times 10^{18}$
   $K_{Y1} = 1.02 \times 10^{-2}$
   $K_{Y2} = 2.14 \times 10^{-3}$
   $K_{Y3} = 6.92 \times 10^{-7}$
   $K_{Y4} = 5.50 \times 10^{-11}$

3. Calculate the solubility of silver sulfide in pure water. (10 points)
   K_{sp} of $Ag_2S = 8 \times 10^{-51}$
   $K_w = 1.00 \times 10^{-14}$
   K_{a1} of $H_2S = 9.6 \times 10^{-8}$
   K_{a2} of $H_2S = 1.3 \times 10^{-14}$

4. Give all kind of multichannel photon transducer. (8 points)

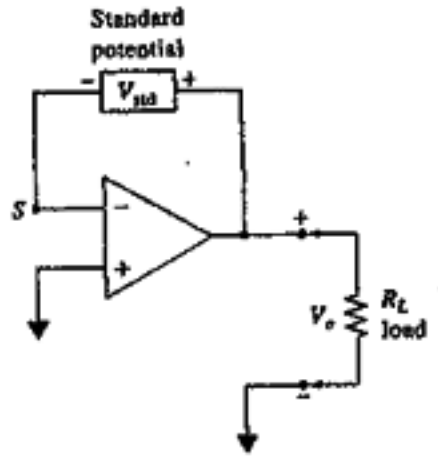
5. Describe or explain what is, for instance, what kind of device, or what purpose, or what application, in the following figures: (5 points each, total 60 points)

(1)

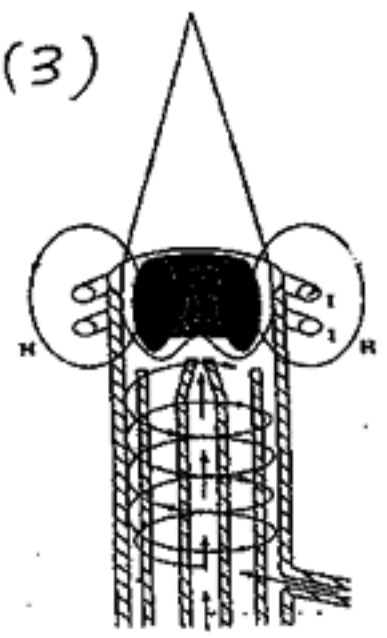


(背面仍有題目,請繼續作答)

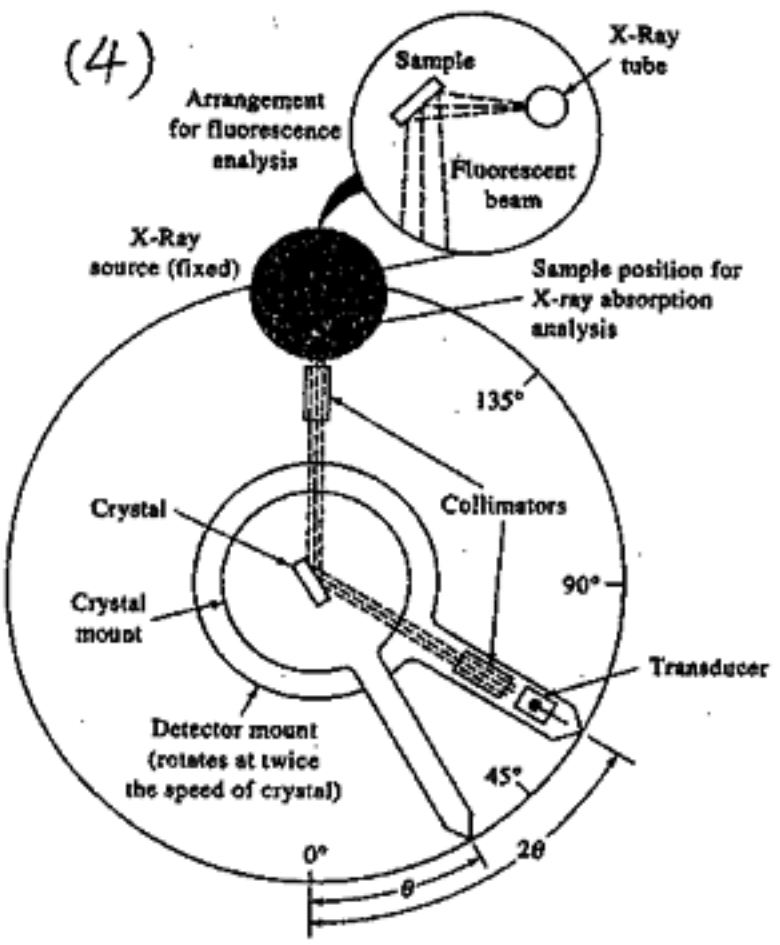
(2)


Standard potential
V_{std}
S
V_o
R_L load

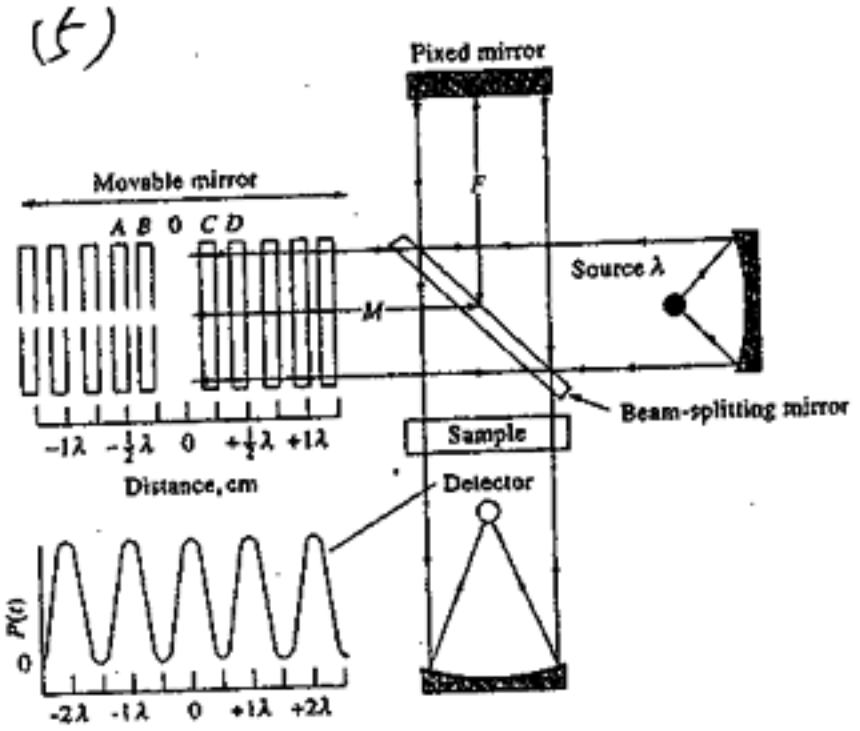
(3)


H
H

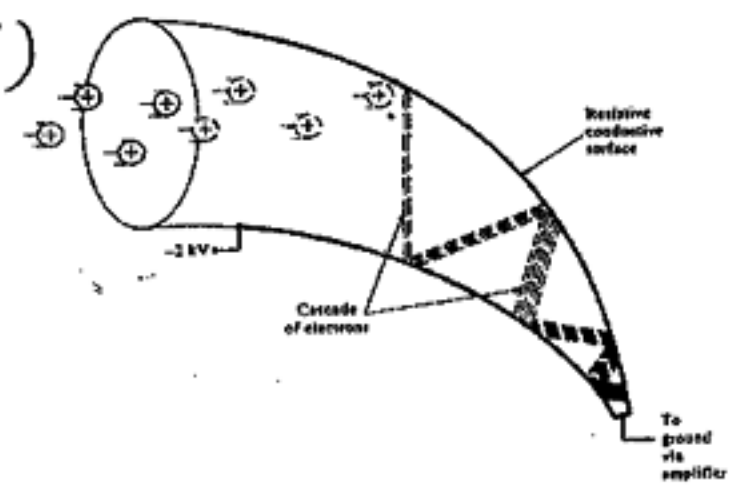
(4)


Sample
X-Ray tube
Arrangement for fluorescence analysis
Fluorescent beam
X-Ray source (fixed)
Sample position for X-ray absorption analysis
135°
Collimators
Crystal
Crystal mount
90°
Transducer
Detector mount (rotates at twice the speed of crystal)
45°
0°
θ
2θ

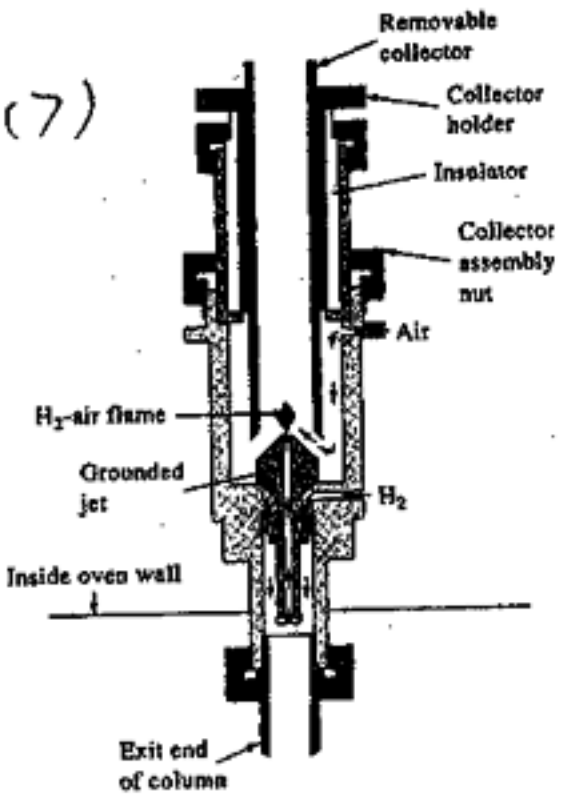
(5)


Fixed mirror
Movable mirror
A B 0 C D
F
M
Source λ
Beam-splitting mirror
Sample
Detector
-1λ $-\frac{1}{2}\lambda$ 0 $+\frac{1}{2}\lambda$ $+1\lambda$
Distance, cm
P(t)
0
-2λ -1λ 0 +1λ +2λ

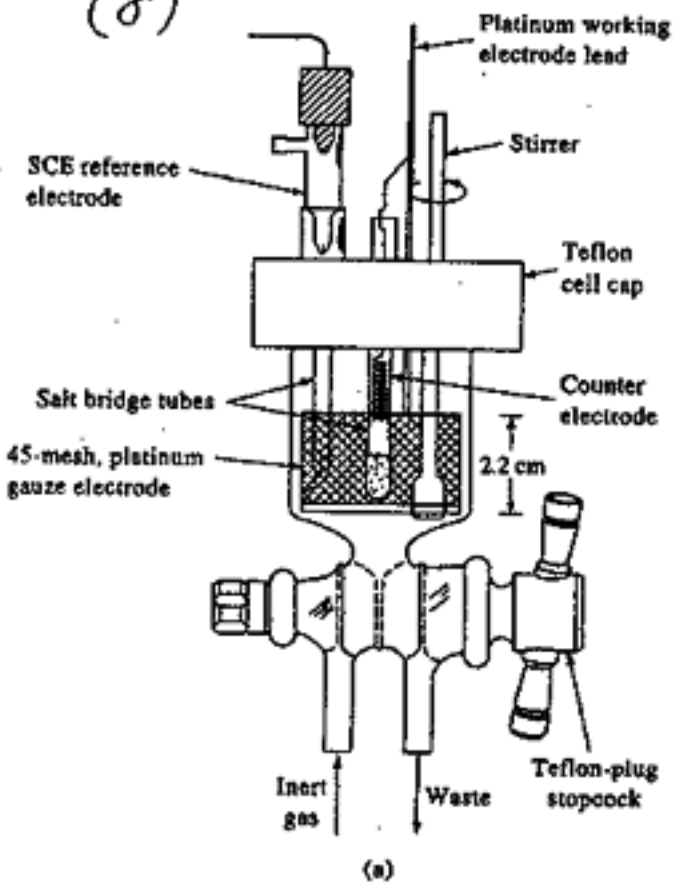
(6)


Resistive conductive surface
-2 kV
Cascade of electrons
To ground via amplifier

(7)

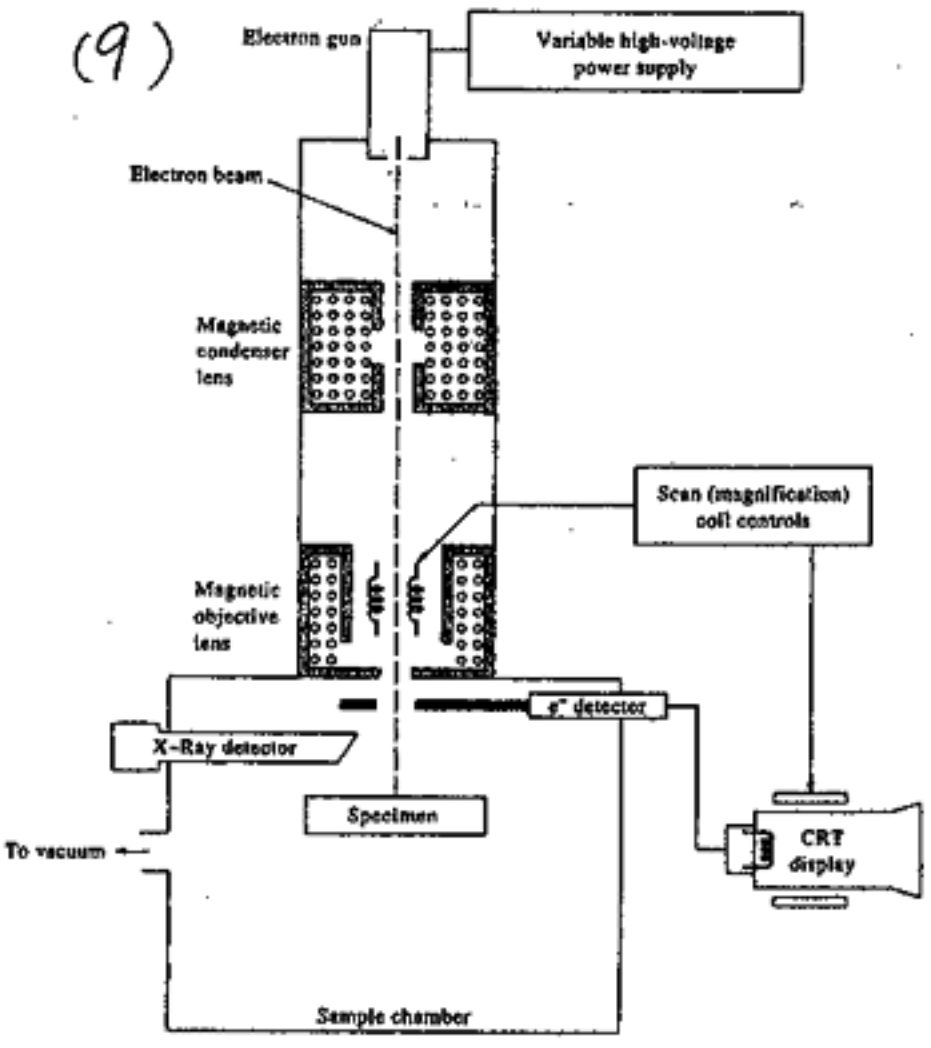

Removable collector
Collector holder
Insulator
Collector assembly nut
Air
H_2-air flame
Grounded jet
H_2
Inside oven wall
Exit end of column

(8)

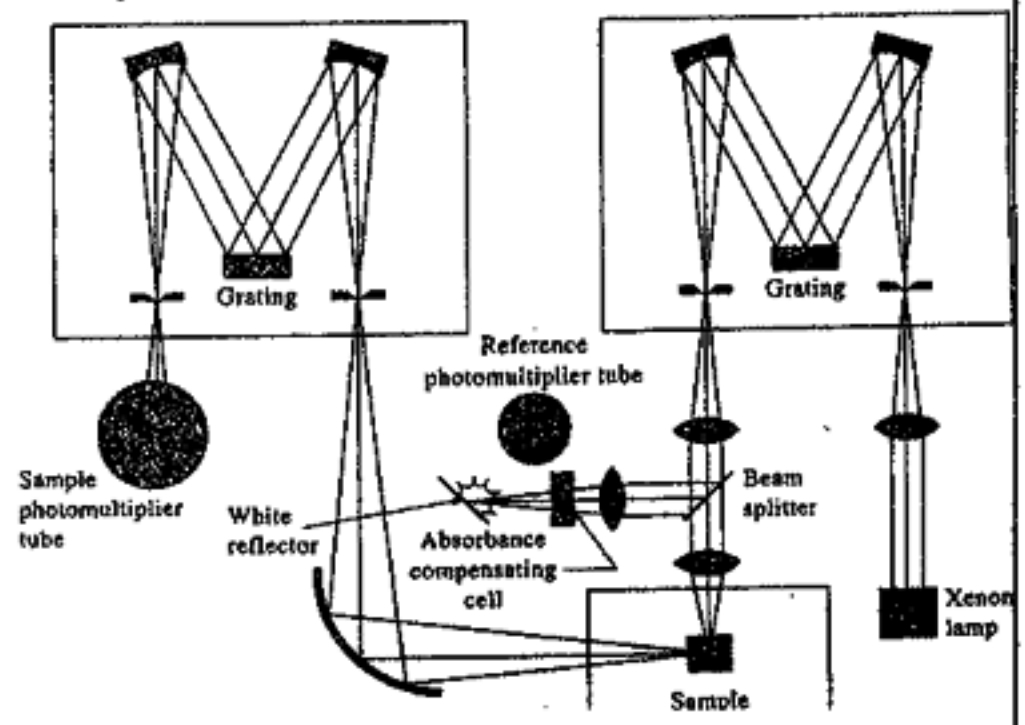

Platinum working electrode lead
Stirrer
SCE reference electrode
Teflon cell cap
Salt bridge tubes
Counter electrode
45-mesh, platinum gauze electrode
2.2 cm
Inert gas
Waste
Teflon-plug stopcock

(a)

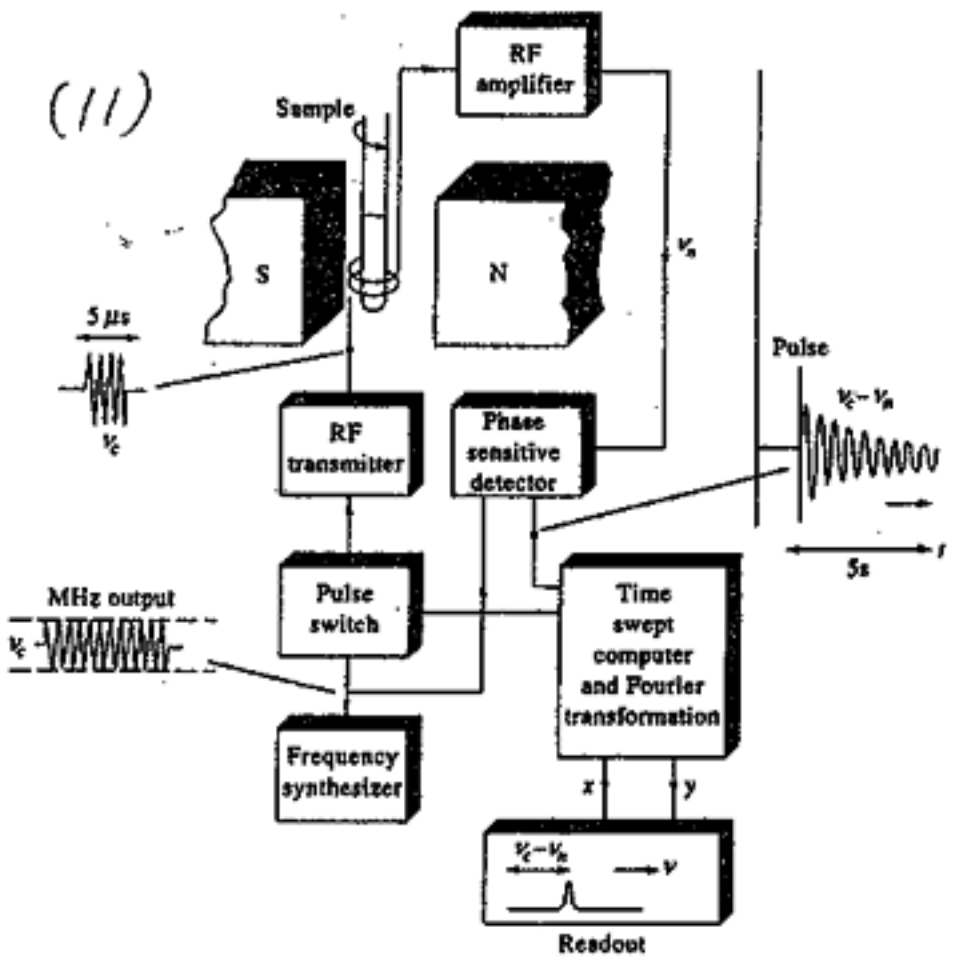
(9)


Electron gun
Variable high-voltage power supply
Electron beam
Magnetic condenser lens
Scan (magnification) coil controls
Magnetic objective lens
X-Ray detector
Specimen
To vacuum
CRT display
Sample chamber

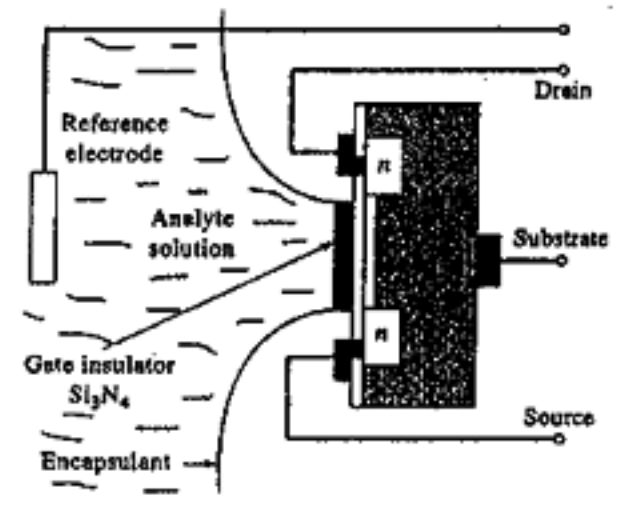
(10)


Grating
Grating
Reference photomultiplier tube
Sample photomultiplier tube
White reflector
Absorbance compensating cell
Beam splitter
Xenon lamp
Sample

(11)


RF amplifier
Sample
S
N
5 μs
Pulse
RF transmitter
Phase sensitive detector
Pulse switch
MHz output
Time swept computer and Fourier transformation
Frequency synthesizer
Readout

(12)


Drain
Reference electrode
Analyte solution
Substrate
Gate insulator Si_3N_4
Source
Encapsulant